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ILLINOIS DEPARTMENT OF
PUBLIC HEALTH
A Healthier Today For A Better Tomorrow

John R. Lumpkin, M.D., Director

September 2, 1994

Case #401018801H

Sam Borries
USEPA
77 West Jackson
Chicago, Il 60604

Dear Sam:

I have enclosed a copy of the health consultation for Site G for your review. If you have any comments, please send them to me at the address given below. In addition, if have any questions or need additional information please contact me at the Edwardsville Regional Office, 22 Kettle River Drive, Edwardsville, Illinois, 62025, telephone (618) 656-6680.

Sincerely,

Dave Webb

David R. Webb
Environmental Toxicologist

ATTACHMENT

cc: Division of Environmental Health
Edwardsville Regional Office

HEALTH CONSULTATION

SITE G - AREA 1 - SAUGET SITES

SAUGET, ST. CLAIR COUNTY, ILLINOIS

CERCLIS # - Currently being scored

August 24, 1994

Prepared by

Illinois Department of Public Health
Under Cooperative Agreement with the
Agency for Toxic Substances and Disease Registry

Edwardsville, Illinois

Case # 401018801H - First Draft

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BACKGROUND AND STATEMENT OF ISSUES

The Agency for Toxic Substances and Disease Registry (ATSDR) has requested that the Illinois Department of Public Health (IDPH) review and respond to a data package for site G of the Sauget Sites Area 1 [1]. The U.S. Environmental Protection Agency (USEPA) Region 5 had requested that ATSDR review the results of their most recent air and surface soil sampling data and determine if site G poses an imminent threat to human health [2].

Site G was a borrow pit that was subsequently used as a subsurface disposal area. The site covers approximately 4.5 acres in Sauget and is bordered by Queeny Avenue to the north, Dead Creek to the east, a cultivated field to the south, and Wiese Engineering on the west.

Debris and vegetation cover most of the site. Site features include two small pits in the northeast and east central portion of the site, the western portion of the site contains a mounded area and large depression just south of the mound, which collects much of the sites runoff water. The site has oily and tar-like wastes on the surface in some areas. The presence of high organic contamination in surface soils led to the construction, in May 1987, of a chain-link fence that surrounds site G.

The population of the communities surrounding site G are: Sauget, 197; Cahokia, 17,550; Centreville, 2960; Alorton, 2960; and E. St. Louis, 40,941. The population within a three-mile radius of site G is estimated to be 60,750 and includes all of Sauget, Cahokia, Centreville, and Alorton and four-fifths of population of East St. Louis. The population within the two-mile radius of site G is estimated to be 31,447, which includes all of Sauget and Alorton, half of Centreville, three-fourths of Cahokia, and one-third of East St. Louis. The population within a one-mile radius is estimated to be 4,146, and includes all of Sauget, one-sixth of Cahokia, and one-fortieth of East St. Louis. The nearest residence to site G is west of the site along Route 3 and within 700 feet of the site.

Land use in Sauget is primarily industrial, however residential, commercial, and agricultural areas are interspersed throughout the community. Industries in Sauget include Monsanto's Krummerich Plant, Big River Zinc smelter, and Cerro Copper.

Several investigations and sampling events have taken place in and around the Area 1 Sites, including site G. The first study was performed by the Illinois Environmental Protection Agency (IEPA) and the results were reported in the Preliminary Hydrogeologic Investigation in the Northern Portion of Dead Creek and Vicinity in 1980-81 also known as the St. John Report [3].

Ecology and Environment performed a pre-Remedial Investigation (RI) for Illinois Environmental Protection Agency (IEPA), the report is date March, 1988 [4]. A draft health consultation of the area one sites was written by the IDPH [5].

Recent events at site G include flooding and a series of fires. High rainfall amounts in the summer of 1993 caused the water in CS-B to pond, inundating Queeny Avenue and portions of site G. Four or five fires have been reported at site G between April 1994 and June 1994. According to the Sauget Fire Department, which has responded to these fires, the fires started by spontaneous combustion.

In response to the potential contaminant generation and migration from the fires at site G the USEPA took soil, surface water, and air samples while the site was burning. The eight surface soil samples and one surface water sample were taken May 27, 1994. The location of these samples are shown in Figure 1. The water and soil samples were analyzed for organic compounds, dioxins/furans, PCBs/pesticides, and inorganic compounds. Six air samples were taken June 6, 1994. The locations of these samples and the compounds detected in each sample are shown in Figure 2. The wind direction during the air sampling event ranged from the southwest to southeast. The wind speed was calm to very light. Air samples were analyzed for volatile and semivolatile organic compounds, pesticides, and PCBs.

Table 1 summarizes the on-site surface soil and surface water sampling data for the 1994 samples taken by USEPA at site G [6]. Table 2 summarizes the off-site surface soil sampling data for the 1994 samples taken by USEPA at site G [6]. Table 3 is a summary of the dioxins and furan analyses of the on-site surface soil and surface water samples. Table 4 summarizes the dioxins and furan analyses of off-site surface soils. The results in Tables 3 and 4 were also reported in 2,3,7,8-TCDD equivalents. The toxicity equivalency factors (TEF) were used to assess risks associated with exposures to complex mixtures of tetra or more highly chlorinated dibenzo-p-dioxins and dibenzofurans. The toxicity equivalency factors used are from the 1989 update [7].

A summary of the 1994 USEPA air samples are contained in Table 5 [6]. Compounds detected in these samples were acetone, 2-butanone, benzene, ethylbenzene, toluene, xylene, and 1,2,4-trichlorobenzene. All seven compounds were detected in sample AS-1, which was collected on-site and closest to the fire. Three samples; AS-2, AS-5, and AS-6 were taken downwind of the fire, all three samples contained acetone, a common laboratory contaminant. AS-5 was taken in a residential area downwind of the site, approximately 1/4 mile south and was found to contain xylene and 1,2,4-trichlorobenzene.

DISCUSSION

The air and soil samples were taken in response to the fires on-site. The primary concern was that combustion in the presence of the chlorinated compounds on-site would produce dioxins and furans. The fires have reportedly been burning at low temperatures which is ideal for the production of dioxins and furans. In addition, subsurface fires would produce an even better atmosphere for dioxin and furan production.

Dioxin and furan concentrations in the 1994 surface soil samples are higher than they were for the 1987 E & E surface soil samples at site G. This is indicative of dioxin and furan formation from the 1994 fires at site G. This observation is supported by the highest soil dioxin and furan concentrations being found in the areas where combustion took place.

Potential exposures to dioxins and furans from the site may involve three exposure points: on-site workers, employees in nearby businesses and industries, and nearby residents. The routes of exposure are by ingestion, inhalation, and dermal absorption. Potential exposures will be discussed by media.

On-site worker exposure to surface soils is unlikely since site access is restricted by a fence and on-site workers should be wearing the proper level of personal protection. Exposure to employees of nearby businesses and industries, especially those employees that come into direct contact with soil, is expected to occur. Nearby residents would also be exposed if they come into contact with contaminated off-site soils.

Exposure doses were calculated for ingestion of contaminated soils at both on- and off-site sample locations for workers and off-site locations for residents. It is unlikely that the on-site workers will be exposed to surface soils by ingestion, however they are included for purposes of comparison. The calculations used to determine the exposure dose are in appendix A. Table 6 contains the calculated exposure doses for the eight surface soil samples and the minimum risk levels (MRLs) for acute, intermediate, and chronic exposures. Minimal Risk Levels (MRLs) are developed by ATSDR and are an estimate of human exposure to a compound that is not expected to cause noncancerous health effects at that level for a specified period of time. They are supposed to protect the most sensitive individuals (e.g. children). MRLs are not cutoff levels and are not used as predictors of adverse health effects. MRLs do not take into account carcinogenic effects, chemical interactions, multiple routes of exposure, or multi-media exposures. The exposure doses

for the on-site samples were calculated for on-site workers, however is it unlikely that exposure to on-site soils will occur. The exposure doses for the three exposure groups are discussed below.

The nearest off-site worker exposures to contaminated soil would most likely be to employees of Wiese Engineering. Sample 107 was taken off-site along the fence on Wiese Engineering property and would be the most representative of their exposure. The exposure estimate for sample 107 assumes that the workers come into contact with the soil five days a week for fifty weeks per year. The calculated workers oral exposure to dioxins and furans in the soil sample taken from Wiese Engineering property does not exceed the chronic oral MRL for 2,3,7,8-TCDD.

Residential exposure to soil via ingestion was calculated for children and adults. Residential exposure doses were calculated for surface soil ingestion using samples 107, 108, and 109. The calculations assume ingestion of soils seven days a week for fifty two weeks a year.

The exposure dose for the nearest residents was calculated using surface soil sample 107, which was the closest sample to these residences. Residential access to this location would be minimal due to the activity at Wiese Engineering and it is not known whether children live or visit these residences. This sample exceeded the MRLs for ingestion of soil by children, however it may not be representative of the exposures of the nearest residents.

Sample 108 was taken in an overgrown area just south of the site. Residential exposure to soil in this area probably only occurs on a limited. The estimated exposure dose to residents ingesting soil in the area of sample 108 was below the chronic MRL for both children and adults.

Sample 109 was collected in the area where Judith Lane crosses Dead Creek. Residential exposures to surface soils in the vicinity of sample 109 are expected to occur. The estimated exposure doses to residents from ingestion of soil in this area was below the chronic MRL for both children and adults.

Dermal absorption of dioxins and furans from contaminated soils would also occur in both unprotected workers and residents. The exposure doses from dermal absorption may be higher than for those calculated for ingestion of contaminated soils. The absorption of dioxins and furans from soil varies with soil type.

Health effects associated with dioxins and furans are based primarily on animal data from exposure to 2,3,7,8-TCDD. The only known health effect that dioxin has caused in humans is chloracne and the exposure dose necessary to produce chloracne in humans is not known. The human studies have involved primarily dermal exposures. The adequacy of experimental animal exposures to 2,3,7,8-TCDD is adequate for oral exposure, with some dermal exposure data, and little data on inhalation exposures. The toxicity of 2,3,7,8-TCDD varies a great deal between species. Health effects observed in animals from 14 day or less exposures includes developmental effects and death. The health effects observed in animal exposure studies which lasted more than 14 days included liver damage, reproductive toxicity, chloracne, severe weight loss, and death. In addition, 2,3,7,8-TCDD has been shown to be an animal carcinogen and is currently listed as a probable human carcinogen by USEPA based on the animal data.

The exposure calculations for residents are based on a limited number of samples. Additional off-site samples would prove useful for estimating exposure doses, for example from the yard of the nearest residence.

Organic compounds besides dioxins and furans were also detected in the surface soil at site G. These compounds were also detected in previous samples taken from site G. The concentrations of these other organic compounds were detected at or below the levels identified in previous sampling events.

Exposure to surface water on-site and in nearby low lying areas by workers and residents would probably be sporadic. The surface water sample contains very low levels of dioxins and furans. The 2,3,7,8-TCDD equivalent levels were many times less than the MCL for 2,3,7,8-TCDD in drinking water.

The air sampling results did not indicate the release of compounds that had not previously been detected on-site. The source of some of the 1,2,4-trichlorobenzene appears to be site G, however 4.3 ppb was detected in the sample taken 1/4 mile downwind in a residential area and would not have come directly from site G. Airborne PCBs concentrations have been higher in the previous air samples. None of the air samples was analyzed for dioxins or furans. Sample AS-1 was taken near the site of active burning and a dioxin and furan analysis of this sample would have been useful in determining airborne exposure to nearby populations. Little, if any, exposure to dioxins and furans in air would be expected without combustion in areas of site G where chlorinated compounds are present.

CONCLUSIONS

1. No noncancer health effects are expected to occur in residents, on-site workers, or off-site workers from ingestion of surface soils.

2. Combustion of chlorinated compounds on-site has resulted in dioxin and furan formation, with future fires expected to produce additional quantities of these compounds.

3. Off-site surface soil data for dioxins and furans is limited.

4. Dermal absorption of dioxins and furans in surface soils may contribute as much to exposure as the ingestion of surface soils.

5. An increase in dioxin and furan formation and subsequent deposition to off-site areas will increase human exposure to dioxin and furans. Future fires on site G pose a potential health threat from exposure to dioxin and furans. The exposure routes may include inhalation prior to deposit and ingestion of and dermal contact with contaminated soil.

6. Exposure to dioxins and furans in contaminated soils appears likely in off-site soils with exposures being highest to those individuals that come into contact with the surface soil closest to the fenceline.

7. Dioxin and furan concentrations in surface waters on site G are not a health concern, based on sample data and exposure potential.

8. No data for airborne concentrations of dioxins and furans exists for site G, thus exposure to these compounds via inhalation was not calculated for this exposure route. Acute airborne exposures to dioxins and furans from site G are not expected to occur unless there is combustion in areas with chlorinated compounds.

RECOMMENDATIONS

1. Prevent on-site fires to eliminate this source of dioxin and furan formation and the subsequent exposures that would occur to these compounds.

2. Take additional samples in those areas just outside the fence at site G and in the yards of the nearest residents to determine whether these areas pose a threat to public health.

3. Calculate dermal exposure doses. This should be done after the off-site soil is more fully characterized.

4. Analyze air samples for dioxins and furans if additional fires start at site G, so that inhalation exposures may be calculated.

PREPARERS OF REPORT

Preparer: David R. Webb, M.S.
Environmental Toxicologist
Illinois Department of Public Health
Edwardsville Regional Office

Reviewer(s):
Environmental Toxicologist
Illinois Department of Public Health
Central Office, Springfield

Environmental Toxicologist
Illinois Department of Public Health
Central Office, Springfield

REFERENCES

[1] USEPA, Consultation Letter for Sauget Area 1: Site G, from Sam Borries, USEPA to Louise Fabinski, ATSDR. July 7, 1994.

[2] ATSDR, Consultation Request for Sauget Landfill, Area 1: Site G, Sauget, IL, from ATSDR Region 5 to Thomas Long, Ph.D., IDPH. July 11, 1994.

[3] IEPA. 1981. A Preliminary Hydrogeologic Investigation in the Northern Portion of Dead Creek and Vicinity. IEPA, Division of Land/Noise Pollution Control, Springfield, Illinois.

[4] Ecology and Environment. 1988. Remedial Investigation Dead Creek Project Sites at Cahokia/Sauget, Illinois, Final Report, Volumes 1 and 2. IEPA, Division of Land Pollution Control, Springfield, Illinois.

[5] Draft Public Health Assessment, Area 1 - Sauget Sites. 1993. IDPH, Edwardsville, Illinois.

[6] USEPA, Air, Surface Soil and Water Sample Results from Site G, Sauget Illinois. 1994.

[7] Interim Procedures for Estimating Risks Associated with Exposures to Mixtures of Chlorinated Dibenzo-p-Dioxins and -Dibenzofurans (CDDs and CDFs) and 1989 Update. 1989. USEPA, EPA/625/3-89/016.

[8] ATSDR Draft Toxicological Profile for 2,3,7,8-Tetrachloro-dibenzo-p-dioxin. 1987. Agency for Toxic Substances and Disease Registry, Atlanta, GA.

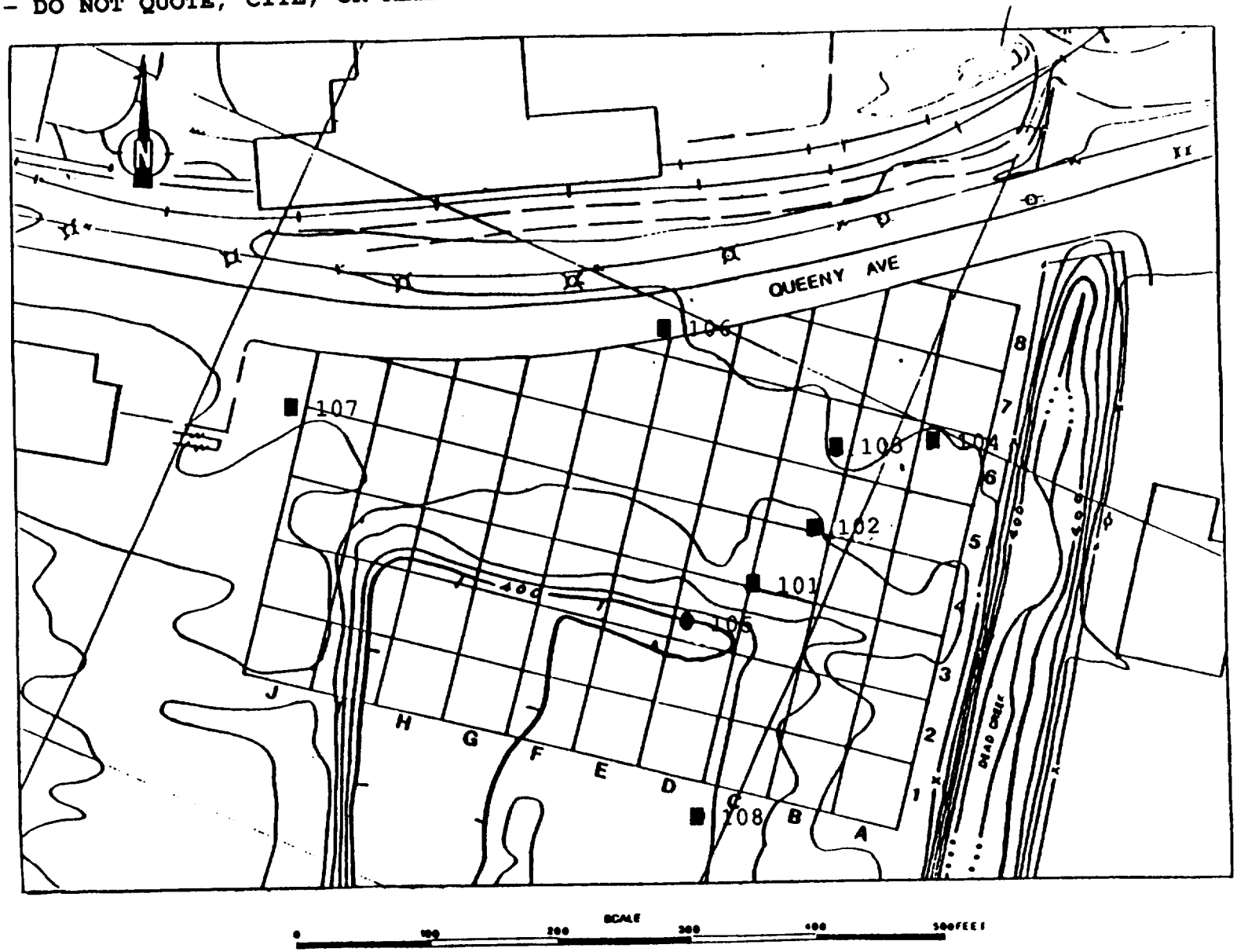

Figure 1. Location of the May 27, 1994 Surface Soil and Surface Water Samples. Source: USEPA, 1994.

■ 109

Gener[illegible] Wind Direction throughout the day

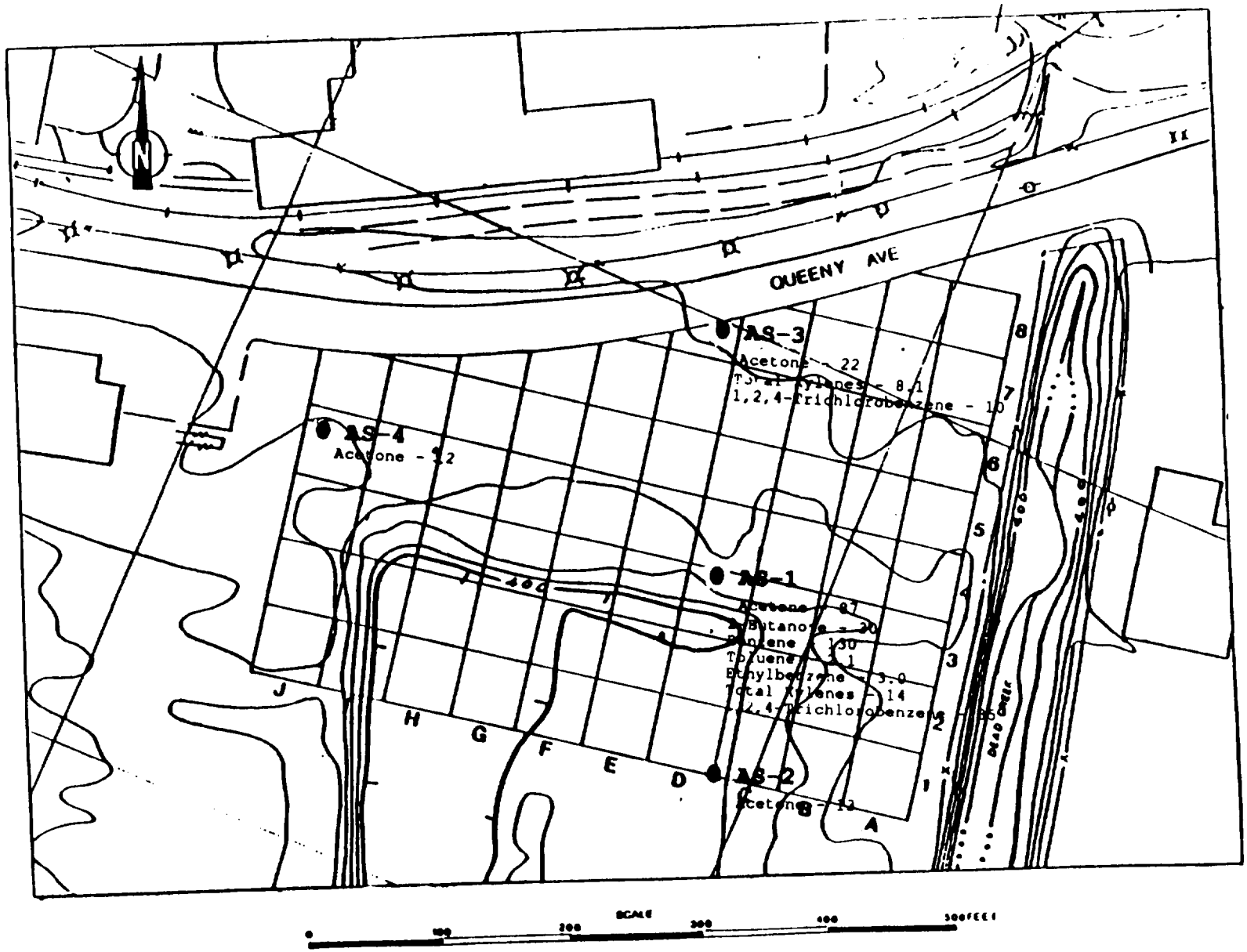

Figure 2. Location and Results of June 6, 1994 Air Sampling at Site G.
Source: USEPA, 1994

● **AS-5: Dead Creek and Judith Lan**
Acetone - 22
Total Xylenes - 2.1
1,2,4-Trichlorobenzene - 4.3

● **AS-6:** Background Sample on Levee Approximately 1 mile Southwest of Site G
Acetone - 20

Table 1. Summary of May 27, 1994 On-site Surface Soil and Surface Water Samples

Compound	On-site					Range in Soils	Comparison Values	
	101	102	103	104	105 (Water in mg/l)		Soil ppm	Source
SEMIVOLATILES								
Phenol	3.3	ND	ND	97	ND	ND-97	1000/30000	RMEG
2,4-Dichlorophenol	ND	ND	ND	250	ND	ND-250	6/200	RMEG
Naphthalene	6.0	400	170	7000	ND	6-7000	NONE	NONE
4-Chloroaniline	ND	ND	ND	1700	ND	ND-1700	8/2000	RMEG
2-Methylnaphthalene	ND	ND	15	130	ND	ND-130	NONE	NONE
2,4,6-Trichlorophenol	ND	ND	ND	200	ND	ND-200	60	CREG
2-Nitroaniline	ND	ND	ND	ND	0.0084 J	ND	NONE	NONE
N-Nitrosodiphenylamine	ND	ND	ND	200	ND	ND-200	NONE	NONE
Pentachlorophenol	2.8	ND	ND	280	ND	ND-280	6	CREG
Phenanthrene	ND	3.7	78 Y	340	ND	ND-340	NL	NL
Fluoranthene	ND	ND	20Y	74	ND	ND-74	80/2000	RMEG
Pyrene	ND	ND	180Y	1000	ND	ND-1000	60/2000	RMEG
Benz(a)Anthracene	ND	ND	45Y	440	ND	ND-440	NL	NL
bis(2-ethylhexyl) phthalate	ND	ND	24	ND	ND	ND-24	NONE	NONE
Chrysene	ND	2.6	110	1300	ND	ND-1300	NONE	NONE
Butyl Benzyl phthalate	ND	ND	120	ND	ND	ND-120	NONE	NONE
Benzo(b)Fluoranthene	ND	ND	25	420	ND	ND-420	NONE	NONE
Benzo(k)Fluoranthene	ND	ND	120	ND	ND	ND-120	NONE	NONE
Benzo(a)Pyrene	ND	ND	25Y	350	ND	ND-350	0.1	CREG
Benzo(g,h,i)Perylene	ND	ND	46	360	ND	ND-360	NONE	NONE

Table 1. Summary of May 27, 1994 On-site Surface Soil and Surface Water Samples

Compound	On-site					Range in Soils	Comparison Values	
	101	102	103	104	105 (Water in mg/l)		Soil ppm	Source
PESTICIDES/PCBs								
DDE	ND	ND	0.95	ND	ND	ND-0.95	2	CREG
DDD	ND	ND	3.5	5.4	ND	ND-5.4	3	CREG
Endrin	190	6.9	ND	3.1	ND	ND-190	20/200	C EMEG
Endrin aldehyde	ND	2.2	5.8	ND	ND	ND-5.8	NL	NL
Aroclor-1260	15000	ND	400	ND	ND	ND-15000	0.01/0.3	C EMEG
DIOXINS AND FURANS								
2,3,7,8-TCDD	INT	0.000059	0.00021	0.00019	ND	ND-0.00041	0.00005/ 0.0007	EMEG
1,2,3,7,8-PeCDD	INT	0.00017	0.0011	ND	ND	ND-0.0000067	NL	NL
1,2,3,4,7,8-HxCDD	0.0011	0.00018	0.0017	0.0096	ND	0.0000067-0.0096	NL	NL
1,2,3,6,7,8-HxCDD	0.0039	0.00043	0.0074	0.029	ND	0.000018-0.032	NL	NL
1,2,3,7,8,9-HxCDD	0.0019	0.00038	0.004	0.02	ND	0.000072-0.02	NL	NL
1,2,3,4,6,7,8-HpCDD	0.2	0.0081	0.27	1.3	ND	0.000058-1.3	NL	NL
OCDD	1.2	0.045	2.3	7.7	0.0000002	0.0022-7.7	NL	NL
2,3,7,8-TCDF	INT	ND	0.00024	ND	ND	ND-0.00024	NL	NL
1,2,3,7,8-PeCDF	INT	0.0013	0.00022	ND	ND	ND-0.0013	NL	NL
2,3,4,7,8-PeCDF	INT	0.0025	0.00083	0.00097	ND	ND-0.0025	NL	NL
1,2,3,4,7,8-HxCDF	0.550	0.0017	ND	0.0031	ND	ND-0.55	NL	NL
1,2,3,6,7,8-HxCDF	0.310	0.00078	0.0017	ND	ND	ND-0.31	NL	NL
2,3,4,6,7,8-HxCDF	0.170	0.00072	0.0017	0.0063	ND	0.0000067-0.17	NL	NL
1,2,3,7,8,9-HxCDF	0.210	0.0001	0.00068	ND	ND	ND-21	NL	NL
1,2,3,4,6,7,8-HpCDF	3.8	0.0027	0.034	0.31	0.000000006	0.00018-3.8	NL	NL
1,2,3,4,7,8,9-HpCDF	5.4	0.00027	0.0045	0.013	ND	0.000014-5.4	NL	NL

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Table 1. Summary of May 27, 1994 On-site Surface Soil and Surface Water Samples

Compound	On-site					Range in Soils	Comparison Values	
	101	102	103	104	105 (Water in mg/l)		Soil ppm	Source
OCDF	0.650	0.0096	0.16	1.4	0.000000028	0.0009-1.6	NL	NL
TOTAL TCDD	INT	0.0035	0.018	0.036	ND	0.000063-0.036	NL	NL
TOTAL PeCDD	INT	0.0016	0.0011	0.012	ND	0.000027-0.012	NL	NL
TOTAL HxCDD	0.019	0.0059	0.05	0.23	ND	0.00067-0.23	0.001	CREG
TOTAL HpCDD	0.390	0.016	0.53	2.7	0.00000002	0.00094-2.7	NL	NL
TOTAL TCDF	INT	0.011	0.54	0.11	ND	0.000028-0.54	NL	NL
TOTAL PeCDF	INT	0.0086	0.017	0.058	ND	0.000043-0.058	NL	NL
TOTAL HxCDF	1.7	0.072	0.034	0.2	ND	0.00008-1.7	NL	NL
TOTAL HpCDF	10	0.0069	0.140	1.1	0.000000035	0.00064-10	NL	NL
INORGANICS								
Arsenic	45	55	8.6	ND	ND	ND-55	0.4	CREG
Barium	1100	3300	330	11000	110	330-11000	100/4000	RMEG
Cadmium	6.4	4.7	6.1	25	ND	4.7-25	0.4/10	C EMEG
Chromium,trivalent hexavalent	43	140	16	58	ND	16-140	2000/50000 10/30	RMEG RMEG
Lead	450	450	210	1200	ND	210-1200	NONE	NONE
Mercury	3.0	2.0	0.83	1.8	ND	0.83-3.0	NONE	NONE
Selenium	ND	ND	ND	ND	ND	ND	6/200	C EMEG
Silver	1.4	ND	2.6	6.5	ND	ND-6.5	10/300	RMEG

Soil values are for pica child/child.
NA = Compound Not Analyzed for in this sample
ND = Not Detected
NL = Not Listed
None = No value for this compound.

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Table 2. Summary of May 27, 1994 Off-site Surface Soil Samples

Compound	Off-site				Range in Soils	Comparison Values	
	106	107	108	109		Soil ppm	Source
SEMIVOLATILES							
Phenol	NA	NA	NA	NA	ND-97	1000/30000	RMEG
2,4-Dichlorophenol	NA	NA	NA	NA	ND-250	6/200	RMEG
Naphthalene	NA	NA	NA	NA	6-7000	NONE	NONE
4-Chloroaniline	NA	NA	NA	NA	ND-1700	8/2000	RMEG
2-Methylnaphthalene	NA	NA	NA	NA	ND-130	NONE	NONE
2,4,6-Trichlorophenol	NA	NA	NA	NA	ND-200	60	CREG
2-Nitroaniline	NA	NA	NA	NA	ND	NONE	NONE
N-Nitrosodiphenylamine	NA	NA	NA	NA	ND-200	NONE	NONE
Pentachlorophenol	NA	NA	NA	NA	ND-280	6	CREG
Phenanthrene	NA	NA	NA	NA	ND-340	NL	NL
Fluoranthene	NA	NA	NA	NA	ND-74	80/2000	RMEG
Pyrene	NA	NA	NA	NA	ND-1000	60/2000	RMEG
Benz(a)Anthracene	NA	NA	NA	NA	ND-440	NL	NL
bis(2-ethylhexyl) phthalate	NA	NA	NA	NA	ND-24	NONE	NONE
Chrysene	NA	NA	NA	NA	ND-1300	NONE	NONE
Butyl Benzyl phthalate	NA	NA	NA	NA	ND-120		
Benzo(b)Fluoranthene	NA	NA	NA	NA	ND-420	NONE	NONE
Benzo(k)Fluoranthene	NA	NA	NA	NA	ND-120	NONE	NONE
Benzo(a)Pyrene	NA	NA	NA	NA	ND-350	0.1	CREG
Benzo(g,h,i)Perylene	NA	NA	NA	NA	ND-360	NONE	NONE
PESTICIDES/PCBs							
DDE	NA	NA	NA	NA	ND-0.95	2	CREG

Table 2. Summary of May 27, 1994 Off-site Surface Soil Samples

Compound	Off-site				Range in Soils	Comparison Values	
	106	107	108	109		Soil ppm	Source
DDD	NA	NA	NA	NA	ND-5.4	3	CREG
Endrin	NA	NA	NA	NA	ND-190	20/200	C EMEG
Endrin aldehyde	NA	NA	NA	NA	ND-5.8	NL	NL
Aroclor-1260	NA	NA	NA	NA	ND-15000	0.01/0.3	C EMEG
DIOXINS AND FURANS							
2,3,7,8-TCDD	0.000036	0.00041	0.0000014	ND	ND-0.00041	0.00005/ 0.0007	EMEG
1,2,3,7,8-PeCDD	ND	0.0036	0.0000048	0.000016	ND-0.0000067	NL	NL
1,2,3,4,7,8-HxCDD	0.00073	0.0076	0.0000067	0.00067	0.0000067-0.0096	NL	NL
1,2,3,6,7,8-HxCDD	0.0021	0.032	0.000018	0.000031	0.000018-0.032	NL	NL
1,2,3,7,8,9-HxCDD	0.0012	0.012	0.000014	0.000072	0.000072-0.02	NL	NL
1,2,3,4,6,7,8-HpCDD	0.088	0.48	0.00051	0.000058	0.000058-1.3	NL	NL
OCDD	0.49	2.1	0.0043	0.0022	0.0022-7.7	NL	NL
2,3,7,8-TCDF	0.00012	ND	0.0000025	0.000007	ND-0.00024	NL	NL
1,2,3,7,8-PeCDF	ND	ND	ND	ND	ND-0.0013	NL	NL
2,3,4,7,8-PeCDF	0.00018	0.0013	ND	0.00002	ND-0.0025	NL	NL
1,2,3,4,7,8-HxCDF	0.00087	0.0078	0.000007	0.000033	ND-0.55	NL	NL
1,2,3,6,7,8-HxCDF	0.00063	0.0084	0.0000056	0.00003	ND-0.31	NL	NL
2,3,4,6,7,8-HxCDF	0.0011	0.015	0.0000067	0.000039	0.0000067-0.17	NL	NL
1,2,3,7,8,9-HxCDF	0.00016	0.00088	0.0000021	0.0000098	ND-21	NL	NL
1,2,3,4,6,7,8-HpCDF	0.026	0.19	0.00018	0.00064	0.00018-3.8	NL	NL
1,2,3,4,7,8,9-HpCDF	0.0022	0.024	0.000014	0.000058	0.000014-5.4	NL	NL
OCDF	0.13	1.6	0.0009	0.0041	0.0009-1.6	NL	NL
TOTAL TCDD	0.00038	0.0035	0.000063	0.00019	0.000063-0.036	NL	NL

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Table 2. Summary of May 27, 1994 Off-site Surface Soil Samples

Compound	Off-site				Range in Soils	Comparison Values	
	106	107	108	109		Soil ppm	Source
TOTAL PeCDD	0.00026	0.0112	0.000027	0.00016	0.000027-0.012	NL	NL
TOTAL HxCDD	0.016	0.2	0.00013	0.00067	0.00067-0.23	0.001	CREG
TOTAL HpCDD	0.18	0.94	0.00094	0.0044	0.00094-2.7	NL	NL
TOTAL TCDF	0.0016	0.011	0.000028	0.00018	0.000028-0.54	NL	NL
TOTAL PeCDF	0.0058	0.055	0.000043	0.00021	0.000043-0.058	NL	NL
TOTAL HxCDF	0.028	0.19	0.00008	0.00036	0.00008-1.7	NL	NL
TOTAL HpCDF	0.076	0.220	0.00064	0.0023	0.00064-10	NL	NL
INORGANICS							
Arsenic	NA	NA	NA	NA	ND-55	0.4	CREG
Barium	NA	NA	NA	NA	330-11000	100/4000	RMEG
Cadmium	NA	NA	NA	NA	4.7-25	0.4/10	C EMEG
Chromium,trivalent hexavalent	NA	NA	NA	NA	16-140	2000/50000 10/30	RMEG RMEG
Lead	NA	NA	NA	NA	210-1200	NONE	NONE
Mercury	NA	NA	NA	NA	0.83-3.0	NONE	NONE
Selenium	NA	NA	NA	NA	ND	6/200	C EMEG
Silver	NA	NA	NA	NA	ND-6.5	10/300	RMEG

Soil values are for pica child/child.
NA = Compound Not Analyzed for in this sample
ND = Not Detected
NL = Not Listed
None = No value for this compound

Table 3. Dioxin and Furan Results for the May 27, 1994 On-site Surface Soil and Surface Water Samples

Compound	I-TEF	101		102		103		104		105 (Water)	
		Actual	TEF	Actual	TEF	Actual	TEF	Actual	TEF	Actual	TEF
2,3,7,8-TCDD	1.0	INT	-	0.000059	0.00006	0.00021	0.0002	0.00019	0.0002	ND	ND
1,2,3,7,8-PeCDD	0.5	INT	-	0.00017	0.00009	0.0011	0.0006	ND	ND	ND	ND
1,2,3,4,7,8-HxCDD	0.1	0.0011	0.0001	0.00018	0.00002	0.0017	0.0002	0.0096	0.001	ND	ND
1,2,3,6,7,8-HxCDD	0.1	0.0039	0.0004	0.00043	0.00004	0.0074	0.0008	0.029	0.003	ND	ND
1,2,3,7,8,9-HxCDD	0.1	0.0019	0.0002	0.00038	0.00004	0.004	0.0004	0.02	0.002	ND	ND
1,2,3,4,6,7,8-HpCDD	0.01	0.2	0.002	0.0081	0.00002	0.27	0.003	1.3	0.01	ND	ND
OCDD	0.001	1.2	0.001	0.045	0.00005	2.3	0.002	7.7	0.008	0.0000002	$2X10^{-10}$
2,3,7,8-TCDF	0.1	INT	-	ND	ND	0.00024	0.000002	ND	ND	ND	ND
1,2,3,7,8-PeCDF	0.05	INT	-	0.0013	0.00007	0.00022	0.00001	ND	ND	ND	ND
2,3,4,7,8-PeCDF	0.5	INT	-	0.0025	0.001	0.00083	0.0004	0.00097	0.0005	ND	ND
1,2,3,4,7,8-HxCDF	0.1	0.550	0.06	0.0017	0.0002	ND	ND	0.0031	0.0003	ND	ND
1,2,3,6,7,8-HxCDF	0.1	0.310	0.03	0.00078	0.00008	0.0017	0.0002	ND	ND	ND	ND
2,3,4,6,7,8-HxCDF	0.1	0.170	0.02	0.00072	0.00008	0.0017	0.0002	0.0063	0.0007	ND	ND
1,2,3,7,8,9-HxCDF	0.1	0.210	0.02	0.0001	0.00001	0.00068	0.00007	ND	ND	ND	ND
1,2,3,4,6,7,8-HpCDF	0.01	3.8	0.004	0.0027	0.00003	0.034	0.0004	0.31	0.003	0.000000006	$6X10^{-11}$
1,2,3,4,7,8,9-HpCDF	0.01	5.4	0.005	0.00027	0.000003	0.0045	0.00005	0.013	0.0001	ND	ND
OCDF	0.001	0.650	0.0007	0.0096	0.00001	0.16	0.0002	1.4	0.001	0.000000028	$3X101^{-11}$
2,3,7,8-TCDD Equivalent			0.14		0.0018		0.00875		0.03		$3X10^{-10}$

Soil values are for pica child/child.
RMEGs and EMEGs values for water are for children.
ITEFs - Interim Toxicity Equivalency Factors, 1989.
Water sample #105 results are in mg/l

Table 4. Dioxin and Furan Results for May 27, 1994 Off-site Surface Soil Samples

Compound	I-TEF	106		107		108		109	
		Actual	TEF	Actual	TEF	Actual	TEF	Actual	TEF
2,3,7,8-TCDD	1.0	0.000036	0.00004	0.00041	0.0004	0.0000014	0.000001	ND	ND
1,2,3,7,8-PeCDD	0.5	ND	ND	0.0036	0.002	0.0000048	0.000003	0.000016	0.000008
1,2,3,4,7,8-HxCDD	0.1	0.00073	0.00007	0.0076	0.0008	0.0000067	0.0000007	0.00067	0.00007
1,2,3,6,7,8-HxCDD	0.1	0.0021	0.0002	0.032	0.003	0.000018	0.000002	0.000031	0.000003
1,2,3,7,8,9-HxCDD	0.1	0.0012	0.0001	0.012	0.001	0.000014	0.000001	0.000072	0.000007
1,2,3,4,6,7,8-HpCDD	0.01	0.088	0.0009	0.48	0.005	0.00051	0.000005	0.000058	0.0000006
OCDD	0.001	0.49	0.0005	2.1	0.002	0.0043	0.000004	0.0022	0.000002
2,3,7,8-TCDF	0.1	0.00012	0.00001	ND	ND	0.0000025	0.0000003	0.000007	0.0000007
1,2,3,7,8-PeCDF	0.05	ND	ND	ND	ND	ND	ND	ND	ND
2,3,4,7,8-PeCDF	0.5	0.00018	0.00009	0.0013	0.0007	ND	ND	0.00002	0.00001
1,2,3,4,7,8-HxCDF	0.1	0.00087	0.00009	0.0078	0.0008	0.000007	0.0000007	0.000033	0.000003
1,2,3,6,7,8-HxCDF	0.1	0.00063	0.00006	0.0084	0.0009	0.0000056	0.0000006	0.00003	0.000003
2,3,4,6,7,8-HxCDF	0.1	0.0011	0.0001	0.015	0.002	0.0000067	0.0000007	0.000039	0.000004
1,2,3,7,8,9-HxCDF	0.1	0.00016	0.00002	0.00088	0.00009	0.0000021	0.0000002	0.0000098	0.000001
1,2,3,4,6,7,8-HpCDF	0.01	0.026	0.0003	0.19	0.002	0.00018	0.000002	0.00064	0.000006
1,2,3,4,7,8,9-HpCDF	0.01	0.0022	0.00002	0.024	0.0002	0.000014	0.0000001	0.000058	0.0000006
OCDF	0.001	0.13	0.0001	1.6	0.0016	0.0009	0.0000009	0.0041	0.000004
2,3,7,8-TCDD Equivalent			0.003		0.023		0.000028		0.0001

Soil values are for pica child/child.
RMEGs and EMEGs values for water are for children.
ITEFs - Interim Toxicity Equivalency Factors, 1989.

Table 5. June 6, 1994 Air Sample Results

Compound	On-site				Off-site		Range	Comparison Value
	AS-1	AS-2	AS-3	AS-4	AS-5	AS-6		
VOLATILES								
Acetone	87	13	22	12	22	20	12-20	400 ppb
2-Butanone	30	ND	ND	ND	ND	ND	ND-30	NONE
Benzene	130	ND	ND	ND	ND	ND	ND-130	0.1/ 2 ppb
Toluene	2.1	ND	ND	ND	ND	ND	ND-2.1	300 ppb
Ethylbenzene	3.0	ND	ND	ND	ND	ND	ND-3.	300 ppb
Xylenes, Total	14	ND	8.1	ND	2.1	ND	ND-14	50 ppb
SEMIVOLATILES								
1,2,4-Trichlorobenzene	35	ND	10	ND	4.3	ND	ND-35	NONE
PESTICIDES/PCBs								
Endosulfan II	0.00	NA	NA	NA	NA	NA	NA-0.00	NONE
Endosulfan sulfate	0.00	NA	NA	NA	NA	NA	NA-0.00	NONE
Aroclor-1254/1260	4.85	ND	ND	ND	ND	ND	ND-4.85	NONE

*MRLs and EMEGS and EPA's RfCs may not protect hypersensitive (allergic) individuals
Air values in ppb unless otherwise noted.
NA - Not Analyzed
ND - Not Detected

Table 6. Exposure Estimates for Dioxins and Furans at Site G

Exposed Individual	On-site				Off-site					
	101	102	103	104	106	107	108	109	Acute MRL	Intermediate and chronic MRL
2,3,7,8-TCDD Equivalent	0.14	0.0018	0.00875	0.03	0.003	0.023	0.000028	0.0001		
Worker	2.9×10^{-8}	2.9×10^{-10}	1.7×10^{-9}	6×10^{-9}	6×10^{-10}	6×10^{-10}	6×10^{-12}	2×10^{-11}	1×10^{-7}	1×10^{-9}
Child, Resident	-	-	-	-	1.8×10^{-8}	1.4×10^{-7}	1.75×10^{-10}	6.25×10^{-10}	1×10^{-7}	1×10^{-9}
Adult, Resident	-	-	-	-	2×10^{-9}	2×10^{-9}	2×10^{-11}	7.14×10^{-11}	1×10^{-7}	1×10^{-9}

ITEFs - Interim Toxicity Equivalency Factors, 1989.

Appendix A

Calculations

Standard Values for Soil Ingestion		
Exposed Individual	Variable	
	Ingestion Rate	Body Weight
Child	100 mg	16 kg
Adult	50 mg	70 kg

Equation

Ingestion Dose = C X IR X EF X 10^{-6}/BW
where C = 2,3,7,8-TCDD Equivalent Concentration
IR = Ingestion Rate
EF = Exposure Factor
10^{-6} = Conversion Factor
BW = Body Weight

EF = exposure frequency X exposure duration/exposure time

The EF used for calculating the residents' exposure was 1 which represents daily exposure, 7 days per week, 52 weeks per year.

The EF used to calculate the workers exposure was 0.29, which represents an exposure for 5 days a week, 50 a year, for 30 years.

Child

Ingestion Dose = C X 100 mg X 10^{-6}/16 kg

Adult

Ingestion Dose = C X 50 mg X 10^{-6}/70 kg